



New Generation Transfer Pump

The Challenge

The River Protection Project employs transfer pumps to move the hazardous nuclear waste in the form of either slurry or supernate between tanks. In 1992 the Environmental Protection Agency issued the "Debris Rule" that had a major effect on how mixed radioactive waste is handled at Hanford. This rule requires, that for environmental compliance, any equipment being buried must be decontaminated to a "low level waste" category prior to burial.

Previously, equipment was buried as removed from the tank with minimum decontamination. The new requirement increased the cost of disposal to a point where the current design approach for transfer pumps needed to be reevaluated to control disposal costs through improved equipment design and operation.

It is projected that transfer pumps will have to move 509 million gallons of waste from 1999 to 2027. Using the current pump technology, over 200 pumps would be required to perform this task. Using the New Generation Transfer Pump (NGTP) technology, only 46 pumps would be required, resulting in a significant cost avoidance.



Fifty-foot-long pump and discharge column suspended by a crane while being lowered into 101-SY. Integral pump/meter unit (left) being inspected by a worker prior to installation.

Current Approach

Vertical turbine pumps, originally designed for agricultural use, are used at Hanford to transfer waste, demonstrating low reliability and operating for only an average of 400 hours before failure. The apparent cause of the premature failure was usually related to seizing of the product lubricated bushings that support the long line shaft or failure of the pump shaft itself resulting from excessive torque. Because of the low pump cost and the relative ease of disposal, this scheme worked for many years. The highly radioactive service meant that pump maintenance or refurbishment was out of the question. Therefore, it was far less expensive just to remove and bury the failed unit and replace the pump.

The current technology lacked the versatility to meet all of the transfer pumping needs at Hanford. The units operated at a fixed speed that resulted in a wide variation in flow rates, depending on the specific transfer route length and conditions. Low flow rates, occurring when there were high head losses from long transfers, contributed to premature pump failure and to transfer line plugging.

In addition, the current technology uses cast iron and carbon steel materials that are more difficult to decontaminate when the equipment service life is over.

Benefits and Features

- ◆ Extended pump operating life
- ◆ Significant cost avoidance
- ◆ Simpler to decontaminate when ultimately removed from the tank for disposal

New Technology

The New Generation Transfer pump is a submersible, centrifugal, two-stage combination pump and motor. The motor is cooled and lubricated by the pumped fluid and is designed to withstand both the temperatures and radiation fields found in the Hanford waste tanks. It is the first of its kind for this service, focusing on reliability, extended life and reduced disposal costs. However, it is a blend of proven technologies and designs from other pump applications, i.e., U.S. Navy Nuclear Reactor Coolant pumps. The projected design life is 10,000 hours of running time over a 10-year period.

Based on the experience with the current technology and the need to address the premature failures, operability problems, the expensive decontamination, and lack of versatility, DOE authorized the New Generation Transfer Pump Program in 1993 to design a pump to achieve four principal goals. This pump was designed, built and tested in a manner consistent with the four goals summarized below:

- 1) Life extension - The components of the NGTP subject to high wear because of the abrasiveness of the pumped fluid were wear-tested using a simulant of the Hanford waste. This included the product-lubricated bearings and other high velocity areas of the pump. The testing results supported a 10,000-hour pump life at maximum speed compared to the 400-hour pump life of the old technology.
- 2) Improved design to reduce disposal costs - The pump and motor were built using austenitic stainless steel to facilitate decontamination and the design was specifically done to eliminate locations where waste could collect. Clear plastic models of the pump were constructed to develop the best possible internal flushing system to minimize potential plugging. The external surface of the pump was machined to a smooth finish to enhance the ability to decontaminate the outside of the pump during removal.

- 3) Improvements in pump operability - These were demonstrated by the performance testing at Savannah River, the pump factory in Pittsburgh, Pennsylvania, and the Hanford run-in testing done at Sulzer Bingham Pumps, Inc. in Portland, Oregon. All of these tests confirmed that the pump met the specified performance requirements.
- 4) Universal waste transfer capability - The NGTP was demonstrated through testing of the variable frequency drive during all of the performance testing. The pump and motor were run at a wide range of speeds from 1686 rpm to 3900 rpm. In addition to demonstrating the versatility of the pump, this testing verified the vibrational stability of the unit under all operating conditions.

The initial pump and motor are being installed in the SY-101 Waste Tank at Hanford as part of the Expedited Waste Transfer Program. It will be used to reduce the fluid level in the SY-101 tank by transferring slurry to the adjacent SY-102 tank.

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